

NEW TRILOBITES FROM BOWNING, WITH NOTES ON *ENCRIINURUS*
AND *CORDANIA GARDNERI*.

By JOHN MITCHELL, late Principal of the Technical College and School of Mines,
Newcastle.

(Plate x.)

[Read 26th March, 1924.]

Introduction.

In 1907 the late General A. W. Vogdes, an eminent authority on trilobites, gave a complete history of the genus *Encrinurus* (Trans. San Diego Soc. Nat. Hist., i. (2), 1907, pp. 61-83), and proposed its division into the genera *Encrinurus* and *Cryptonymus*, claiming that the latter name should be retained for the generic name of the group. If the rule of priority is to be followed strictly, the claim for *Cryptonymus* appears unquestionable, but the fact that *Encrinurus* has been in common use for some eighty years should be taken into consideration.

The separation into *Encrinurus* and *Cryptonymus* depends on the presence or absence of spines on the genal angles: those forms with spines are placed in the genus *Encrinurus*, of which the generic type is *Encrinurus punctatus*; *Cryptonymus* is to include those forms having rounded genal angles, the generic type suggested being *E. variolaris* Brong. As far as the proposed genera and generic types are concerned, the present writer agrees with these divisions, but considers the features on which the separation of the genera is based are not of generic value; he admits that the separation may be useful in practice. If spines on the genal angles be accepted as features having generic or subgeneric values, then several old-established genera are open for similar generic division. Should Vogdes' proposed classification of *Encrinurus* be accepted, all the Australian species recorded up to the present time would have to be placed in *Cryptonymus*, for they all have rounded genal angles.

It has occurred to the writer that a division of the group might be effected on well marked and constant pygidial characteristics, viz:—the continuity or discontinuity of the rings of the axis of the pygidium. Under this classification, those species of *Encrinurus* having continuous axial rings on their pygidia would be placed in the genus *Cryptonymus*, and have *Cryptonymus (Encrinurus) variolaris* for the generic type. Such as have the axial rings of their pygidia discontinuous or medially interrupted, wholly or in part, would form the genus *Encrinurus*, the type species being *Encrinurus punctatus*.

Adopting this classification, the following Australian species would be included in *Cryptonymus*:—*E. etheridgei* E. and M., *E. duntroonensis* E. and M., together with *Cryptonymus platynotus*, *C. incertus*, *C. robustus*, *C. perannulatus*, and *C. angustus*, described in the present paper. In the genus *Encrinurus* would

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Adopting this classification, the following Australian species would be included in *Cryptonymus*:—*E. etheridgei* E. and M., *E. duntroonensis* E. and M., together with *Cryptonymus platynotus*, *C. incertus*, *C. robustus*, *C. perannulatus*, and *C. angustus*, described in the present paper. In the genus *Encrinurus* would

be placed *E. mitchelli*, *E. silverdalensis*, *E. bowningensis*, *E. rothwellae*, and the species *E. frontalis* here described. The solitary *E. (C.) spryi* would find its resting place in *Cryptonymus*.

The writer is aware that to establish a genus on a feature of the pygidium of a trilobite is exceptional; but in the present case, the separation of the genera under discussion, on the lines stated by him above, seems sound and reasonable; and especially does it appear so, when the classification is applied to the Australian species. Also, seeing that the genus *Encrinurus* itself is established on a feature of the pygidium, it seems reasonable, if further division becomes necessary, to use some well-marked pygidial character, as is proposed above.

The general characters for *Encrinurus* would remain as they have been heretofore recognised. The genus *Cryptonymus* would have a head-shield and thorax of the types common to the Encrinuridae, and its separation from *Encrinurus* would depend on the interrupted or continuous rings of the axis of the pygidium.

In the following pages eight new species of trilobites from the Bowning (Bounyongian) beds of New South Wales are described and figured. Two of these (one doubtfully) are placed in the genus *Bronteus (Goldius)*. Six new species are placed in the genera *Encrinurus* and *Cryptonymus*. Up to the present, no less than ten species of *Encrinurus* have been recorded from New South Wales, four (*E. punctatus* Brunn., *E. barrandei* De Kon., *E. (Cromus) bohemicus* and *E. murchisoni* De Kon.) by De Koninck (Foss. Pal. Nouv. Galles du Sud, Pt. I., 1876, pp. 49-55, Pl. i., figs. 8, 9, 9a-b.).

When dealing with the Silurian Encrinuridae of New South Wales, the late R. Etheridge, junior and the writer expressed certain opinions with reference to the correctness and value of these determinations of De Koninck (Proc. Linn. Soc. N.S.W., xl. (4), 1915, pp. 651-654); and the present writer is unaware of any reason why the opinions then expressed should be altered. By the addition of the species of *Encrinurus* and *Cryptonymus* (or *Encrinurus* alone) dealt with in the present paper, the species of these genera have been increased to a greater number than has been recorded from New South Wales for any other genus of trilobite; and still, to the writer's knowledge, there are fragments of new species of these genera awaiting description.

In Europe and North America, *Encrinurus, sens lat.*, is practically confined to the Ordovician and Upper Silurian systems. In New South Wales, species occur from the base to near the top of the Bounyongian beds and, up to the present, the whole of this formation has been considered to be of Upper Silurian age. Recent study, however, has led the writer to conclude that the uppermost beds, at least, are of Lower Devonian age; and in these beds *Encrinurus* is not known to occur. The Yarralumla beds are the equivalents of the Lower Trilobite beds of Bowning, as are also, in part or altogether, the Back Creek beds of the Tarlo River. The age of the Duntroon beds has not yet been satisfactorily solved, but, in the opinion of the writer, they are older than those of Bowning. It may, therefore, be taken as approximately correct that, in New South Wales, and indeed in Australia, *Encrinurus* (including *Cryptonymus*) is confined to the Upper Silurian and older formations.

Family ENCRINURIDAE.

CRYPTONYMUS PLATYNOTUS Mitchell. (Plate x., fig. 1.)

The specimen available has the anterior portion of the head-shield and a small part of the tip of the pygidium missing. The head-shield is subsemi-elliptic, its surface being densely tuberculate, with medium to small tubercles; the surface

be placed *E. mitchelli*, *E. silverdalensis*, *E. bowningensis*, *E. rothwellae*, and the species *E. frontalis* here described. The solitary *E. (C.) spryi* would find its resting place in *Cryptonymus*.

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of the glabella is removed, leaving the greater part of the hypostoma exposed; the neck-furrow is narrow and ill-defined, its lateral extensions wide and distinct; neck-ring and its lateral extensions similar to a thoracic segment; fixed cheeks large, the wings unusually wide postero-anteriorly, densely tuberculate, the tubercles being arranged in nearly regular rows; eyes placed well forward and outward. Thorax much wider than long (25:15 approx.), smooth; axis spindle-shaped, widest at the third and fourth rings, mildly convex, each ring subtuberculate at its bases; axial furrows deep; side lobes almost horizontal between their origin and their fulera, thence steeply deflected; an indistinct tubercle at the fuleral point of each pleura; terminals of the pleurae strongly imbricate and curved forward. Pygidium triangular, moderately convex, about two-thirds as long as wide (13:20); axis mildly convex, rings continuous, about twenty-two in number (on the specimen there are nineteen, but a part of its end is broken off); medially there are five inconspicuous tubercles; the junction with the thoracic axis is quite gradual. Pleurae of the side lobes are 9 to 10, each, except the first, slopes gently from the origin to the margins and ends in ploughshare-like edges, having a fairly strong backward curve.

On a casual inspection this may easily be taken for *E. mitchelli*; but from that species it is separated by (1) the great size of its fixed cheeks and their alae, (2) the continuity of the axial rings of its pygidium, (3) the gradual merging of the thoracic axis into that of the pygidium, (4) the more forward position of the eyes, and (5) less convexity and prominence of the axis. From *E. bowningensis* and *E. silverdalensis* E. and M., it is easily distinguished. In the size of its fixed cheeks and forward position of the eyes it resembles *E. rothwellae*; but differs from that species, widely in other respects.

The outstanding features of the species are the large fixed cheeks, anterior and lateral position of the eyes, general low convexity, continuity of the axial rings of the pygidium, and the indistinctness of the medial tubercles of the pygidial axis.

Loc.—Bowning Creek, Lower Trilobite beds.

CRYPTONYMUS INCERTUS, n.sp. (Plate x., fig. 2.)

Of this species only the pygidium, with two complete thoracic segments attached, is known. The description of the pygidium is as follows: Triangular, about two-thirds as long as wide, fairly well inflated, smooth or nearly so. Axis prominent, convex, made up of numerous rings (more than twenty), ending bluntly short of the posterior margin, subtended by a pair of pleural segments, its greatest spread approximately equals one-fourth of the greatest width of the pygidium (5:19); its junction with the thorax is quite gradual, along the medial line there are faint traces of two tubercles. Side lobes consist of twelve pairs of pleurae, convex, only the posterior three pairs strongly directed backwards, geniculation indistinct. *Dimensions*: Length 13 mm., width 19; greatest height of axis 5; greatest height of side lobes 4 mm.

The present pygidium resembles, in general contour and pleural characters, *E. bowningensis* more than it does any other Australian species; but from the pygidium of this species it differs in having twelve pairs of pleurae instead of nine, the axis ending short of the margin, and in its rings being continuous. These differences alone are sufficient to separate the two specifically. The pygidium of *C. robustus* mihi and the one under discussion agree in several features, but the former is densely, finely and evenly granulated, while the latter appears

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to be practically smooth; the pleurae of the former are less in number and less prominent than those of the latter. The pygidium of the latter does not possess the distinct border which is present in the former.

Loc. and horizon.—Railway cutting near the Bowring railway station. Upper Trilobite Beds, Bounyongian Series.

CRYPTONYMUS ROBUSTUS, n.sp. (Plate x, fig. 3.)

Complete form oval. Head-shield almost semicircular, densely tuberculate. Glabella pyriform, mildly convex, greatest width equal to length, tubercles relatively large and fairly even in size, not prominent, those adjacent to the anterior margin arranged subconcentrically, the posterior ones forming one or two transverse rows, the remainder irregularly placed. There are five pairs of glabellar furrows and, if such they may be called, the lobes are conspicuous, subquadrate in shape and depressed, the posterior pair being inconspicuous; axial furrows deeply incised. The lobe-like tubercles of the fixed cheeks, corresponding to and opposite those of the glabella, are prominent; neck-furrow inconspicuous, its lateral extensions across the fixed cheeks narrow and deep, neck-ring narrow, fairly prominent and granulated, its lateral extensions also narrow. Fixed cheeks well developed, wide between the facial sutures and the posterior furrows, its granulation like that of the glabella, moderately inflated, lower than the glabella. Free cheeks large, inflated, lateral furrows and thickened borders conspicuous, the anterior parts between the exits of the facial sutures and the axial furrows flat, wide and joining squarely. Eyes subellipsoidal in shape, sunken within their surrounding furrows, rather widely apart, the anterior tubercles, forming the circlets around the eye furrows, large, visual area depressed; posterior branches of the facial sutures run from the back of the eye in a slightly oblique curve; genal angles rounded; axial furrows conspicuous. Thorax transversely oblong, twice as wide as long, sparsely granulated. Pygidium triangular, much wider than long (30:18), finely granulated. Axis gently convex, medially subdepressed; rings apparently twenty-four in number, continuous, segmented portion ending bluntly before the margin is reached, the remainder appearing to be joined to the pleurae of the side lobes; no tubercles visible along the medial line. Side lobes made up of eleven pairs of pleurae, or perhaps twelve, moderately convex, deflect mildly from the axial grooves, their backward curve is gentle and regular, anterior pair conspicuously faceted, their marginal ends are chisel-like. *Dimensions*: Total length, 52; length of head, 16; length of thorax, 18; of tail, 18; width of thorax, 34; spread of thoracic axis, 10 mm.

This species shows some resemblance to *E. mitchelli* Foerste, but differs in quite a number of features as follows: The eyes of our species are wider apart and are ellipsoidal instead of circular, as well as less prominent; the tuberculation of the cephalon generally is coarser, less prominent and orderly arranged; its pseudo-glabellar lobes are larger and more quadrate in shape; the spaces between the posterior branches of the facial sutures and the posterior furrows of the cephalon are wider and these furrows are narrower in *C. robustus*; the parts of the free cheeks between the emergence of the axial grooves, and the facial sutures in front of the glabella are flat, not lobed; the axial rings of the pygidium are continuous; tubercles appear to be absent along the medial line of the pygidium. These differences appear to warrant its separation from *E. mitchelli*. It may be noted further that the head of this species bears more than a passing resemblance to the head of *Encrinurus* (*Cromus*) *bohemicus* Barr., but is easily separated from



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that species. It is quite possible De Koninck made his determination of the presence of *C. bohemicus* in the rocks of New South Wales (Mem. Geol. Surv. N.S. Wales, Pal. No. 6), from a head of the present species, mistaking it for the Bohemian species. It is easily separated from all other Encrinurids which have come under the writer's notice.

Loc. and horizon.—Limestone Creek, near Goodyer's hut, on the Yass-Burrurua Road, Parish of Bowning, County of Harden. Lower Trilobite Beds, Bounyongian Series.

CRYPTONYMUS PERANNULATUS, n.sp. (Plate x., fig. 4.)

Pygidium triangular, moderately inflated, apparently smooth and wider than long (12:10). Axis very slightly convex, and very slightly elevated above the side lobes, from which it is separated by faint axial grooves; it possesses about forty-four continuous rings, reaches the posterior margin, greatest width 3 mm., or one-fourth of the anterior width of the pygidium. Side lobes show thirteen pairs of segments; the posterior inclination of the segments is mild and they terminate at the margin with straight edges; the deflection of the pleurae from the axial grooves is steep throughout and posteriorly almost vertical.

The other parts of this species have not been determined; but the features of this pygidium are so clearly different from all pygidia of the genus which have come under my observation, that I have no hesitation in giving it specific rank.

Associated with this pygidium there occur several cephalae and pygidia as well as some free cheeks which were referred to by the late R. Etheridge and the writer some years since; and it is possible that the cephalon and free cheek described and figured by these writers (Proc. Linn. Soc. N.S.W., xl., 1915, Pl. lvi., figs. 7, 9) belong to the species now under discussion. The free cheek in question was then placed with *E. etheridgei*, but evidence now available discloses that it does not belong there, because the facets of the eyes are very fine and numerous, while the facets of the eyes of *E. etheridgei* and of the Bounyongian Encrinurids generally are relatively few in number, large in size and less conical in shape.

Loc.—Gurnett's farm, three miles west of Bowning township.

CRYPTONYMUS ANGUSTUS, n.sp. (Plate x., figs. 5, 6.)

Pygidium (testless), which is the only part known for certain, acutely triangular, finely granulated, high anteriorly, and strongly drooping posteriorly, longer than wide. Axis made up of some 30 or more continuous rings, narrow, its anterior width being one-fifth of the anterior width of the pygidium, reaching to the margin, ending bluntly; axial grooves faint. Side lobes made up of twelve pairs of pleurae, the first pair only being geniculated, the others deflect strongly from their origin to the margins, and all have an increasingly oblique direction posteriorly. The axis is very prominent anteriorly, but gradually becomes less so posteriorly, until before the margin is reached it is inconspicuous. Dimensions: Length, 13; width, 10 mm.

The outstanding features of this pygidium are its narrowness; steep, adpressed sides; narrow, anteriorly elevated axis; few and inconspicuous tubercles along the medial line of the axis. It is plain, from the axis of this pygidium, that the axis of the thorax of the species would be narrow, and also that the glabella would be narrow, at least posteriorly; and such a glabella was obtained from Gurnett's selection, and tentatively placed (Proc. Linn. Soc. N.S.W., xl., 1915, pp. 672, 673, Pl. lv., figs. 7, 8) with *E. etheridgei* E. and M. because of its

that species. It is quite possible De Koninek made his determination of the presence of *C. bohemicus* in the rocks of New South Wales (Mem. Geol. Surv. N.S. Wales, Pal. No. 6), from a head of the present species, mistaking it for the Bohemian species. It is easily separated from all other Encrinurids which have come under the writer's notice.

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Pygidium triangular, moderately inflated, apparently smooth and wider than long (12:10). Axis very slightly convex, and very slightly elevated above the side lobes, from which it is separated by faint axial grooves; it possesses about forty-four continuous rings, reaches the posterior margin, greatest width 3 mm., or one-fourth of the anterior width of the pygidium. Side lobes show thirteen pairs of segments; the posterior inclination of the segments is mild and they terminate at the margin with straight edges; the deflection of the pleurae from the axial grooves is steep throughout and posteriorly almost vertical.

The other parts of this species have not been determined; but the features of this pygidium are so clearly different from all pygidia of the genus which have come under my observation, that I have no hesitation in giving it specific rank.

Associated with this pygidium there occur several cephalae and pygidia as well as some free cheeks which were referred to by the late R. Etheridge and the writer some years since; and it is possible that the cephalon and free cheek described and figured by these writers (Proc. Linn. Soc. N.S.W., xl., 1915, Pl. lvi., figs. 7, 9) belong to the species now under discussion. The free cheek in question was then placed with *E. etheridgei*, but evidence now available discloses that it does not belong there, because the facets of the eyes are very fine and numerous, while the facets of the eyes of *E. etheridgei* and of the Bounyongian Encrinurids generally are relatively few in number, large in size and less conical in shape.

Loc.—Gurnett's farm, three miles west of Bowning township.

CRYPTONYMUS ANGUSTUS, n.sp. (Plate x., figs. 5, 6.)

Pygidium (testless), which is the only part known for certain, acutely triangular, finely granulated, high anteriorly, and strongly drooping posteriorly, longer than wide. Axis made up of some 30 or more continuous rings, narrow, its anterior width being one-fifth of the anterior width of the pygidium, reaching to the margin, ending bluntly; axial grooves faint. Side lobes made up of twelve pairs of pleurae, the first pair only being geniculated, the others deflect strongly from their origin to the margins, and all have an increasingly oblique direction posteriorly. The axis is very prominent anteriorly, but gradually becomes less so posteriorly, until before the margin is reached it is inconspicuous. Dimensions: Length, 13; width, 10 mm.

The outstanding features of this pygidium are its narrowness; steep, adpressed sides; narrow, anteriorly elevated axis; few and inconspicuous tubercles along the medial line of the axis. It is plain, from the axis of this pygidium, that the axis of the thorax of the species would be narrow, and also that the glabella would be narrow, at least posteriorly; and such a glabella was obtained from Gurnett's selection, and tentatively placed (Proc. Linn. Soc. N.S.W., xl., 1915, pp. 672, 673, Pl. lv., figs. 7, 8) with *E. etheridgei* E. and M. because of its

resemblance to the cephalon of that species, and there, for the present it must remain.

It must be noted too that the pygidia previously figured (*loc. cit.*, pp. 673, 674, Pl. lv., figs. 9, 10) resemble, in several particulars, the one under review, but they are approximately as wide as long, with wider and inconspicuous axes, and thirteen pairs of pleurae.

It may be pointed out here, that the pygidia from Gurnett's selection are of different types from those of the trilobites from the adjacent Bounyongian Series. This probably indicates some difference in the geological horizon of the two places.

Loc.—Gurnett's selection, west of Bowning.

ENCRINURUS FRONTALIS, n.sp. (Plate x., fig. 7.)

Only a cephalic shield, minus the free cheeks, is known. The specific characters are:—Glabella subpyriform, front margin semicircular, width in front greater than the length, tuberculate, tubercles varying in size, arranged subconcentrically, except for a row in front of the neck furrow which is transverse; on each side are four conspicuous tubercles (possibly there were five originally), some of which are surmounted by a smaller one and separated from each other by pronounced pseudo-glabellar furrows; neck-furrow narrow and deep, its lateral extensions also deep; neck-ring strongly arched, bearing a conspicuous tubercle at each point of origin and between these are a few inconspicuous ones; lateral extensions narrow and prominent, bearing a few faint granules. Fixed cheeks of moderate size, inflated, nearly as high as the glabella, tubercles in oblique rows, separated from the glabella by deep axial furrows; eyes circular, facets rather large, visual surface depressed, distinctly separated from the cheeks by a well defined furrow. Facial sutures of the usual character for the genus. Free cheeks unknown.

This fragmentary head resembles *Encrinurus mitchelli* more than any other *Encrinurus* known to me; but it differs from that species in having the glabella wider than long; the eyes wider apart; an additional row of tubercles between the eyes and the axial furrows; the neck furrow and its lateral extensions deeper and the latter at least narrower; fixed cheeks more inflated; glabellar lateral lobes and furrows more distinct; glabella more tumid and its tuberculation more crowded, irregular and prominent. These differences are ample to separate these two species. It also resembles *E. punctatus* Brunn. more closely than does any other Australian Encrinurid.

Loc. and horizon.—A quarter of a mile south of the Bowning public school. Associated with *Dalmanites (Hausmannia) meridianus* E. and M., *D. loomesi*, etc. This is the only *Encrinurus* which has been obtained from the Middle Trilobite Beds of the Bounyongian series.

CRYPTONYMUS (ENCRINURUS) DUNTROONENSIS E. and M. (Plate x., figs. 10, 11.)

Encrinurus duntroonensis, Proc. Linn. Soc. N.S.W., xl., 1915, 670-1, 674, 675 (*b* and *c*), Pl. lv., figs. 13, 14, Pl. lvi., figs. 11, 13. The two pygidia, previously described (*loc. cit.*) and thought to be specifically distinct from the cephalon described as *E. duntroonensis*, are now regarded, with an additional two specimens, as belonging to the same species. The axes of two of the four pygidia under examination appear to have suffered compression. The following is the description of the normal pygidium: Triangular, slightly wider than long (8:7), granulation faintly indicated. Axis moderately prominent, rings thirty or more, con-

resemblance to the cephalon of that species, and there, for the present it must remain.

It must be noted too that the pygidia previously figured (*loc. cit.*, pp. 673, 674, Pl. lv., figs. 9, 10) resemble, in several particulars, the one under review, but they are approximately as wide as long, with wider and inconspicuous axes, and thirteen pairs of pleurae.

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tinuous; posteriorly the axis droops steeply and ends at the margin closely invested by the terminal pair of pleurae; axial grooves faint. Side lobes strongly inflated, fulera close to the axial grooves, from thence the lobes deflect almost vertically; each pair of pleurae from the second to the ninth pair posteriorly has a decided *f*-like shape; apparently there are twelve pairs of pleurae, certainly eleven, ending at the margin with a straight edge, and the whole pygidium has the form of an equilateral triangle. Dimensions: Length, 7; width, 8; height, 3; anterior spread of axis, 2.5 mm. A compressed specimen has length 7, width 5, spread of axis 2 mm.

That the pygidia formerly referred to (*loc. cit.*), and again described above, belong to *Encrinurus duntroonensis* seems a reasonable conclusion because they are the only pygidia found associated with the cephalon on which the species was established, and the glabella of the type cephalon is narrow, and consequently, the axis of its thorax and pygidium must also have been (unusually) narrow as is the case with the pygidia under notice; for these reasons I place them with that species without hesitation.

The pygidia of Silurian age from Europe most closely resembling these now under notice, are those of *Encrinurus seebachi* Schmidt, which agree in shape, proportionate length to width, and number of rings in the axes; but the local ones have a larger number of pleural segments, and these slope much more steeply from the axial grooves to the margin than do those of *E. seebachi*.

Loc. and horizon.—A small creek near Duntroon homestead, Parish of Canberra, County of Murray. Upper Silurian or perhaps older.

ENCRINURUS MITCHELLI Foerste. (Plate x., figs. 12, 14.)

Encrinurus mitchelli Foerste, Bull. Sci. Lab. Denison Univ., iii., Pt. 2, 1888, p. 124, Pl. xiii., figs. 2, 3, 20.—(?) *Cromus murchisoni* De Koninck, Foss. Pal. Nouv. Galles du Sud, 1876, Pt. 1, Pl. 1., fig. 9 (exclude figs. 9a and 9b).—*E. mitchelli* Etheridge and Mitchell, Proc. Linn. Soc. N.S.W., xl., 1915, pp. 657-662, Pl. liv., figs. 1-5, Pl. lv., figs. 1-3, 15, Pl. lvi., figs. 2, 10, Pl. lvii., fig. 9.

A careful study of a large number of specimens of this species enables me to add an important point or two to former descriptions. In the original description by the late R. Etheridge, junior, and Mitchell the axis of the pygidium is said to terminate mucronately and to possess twenty-six rings; but instead of that some well preserved pygidia show that it ends in a fairly fine, rounded point in front of the submucronate terminal formed by the coalescence of the last pair of the pleurae; and that it bears thirty-two annulations, or more, in mature specimens, also, in the description referred to, doubt was expressed whether there were ten or eleven pairs of pygidial pleurae. It may now be stated definitely, that in all specimens of the species which do not exceed $1\frac{1}{2}$ inches in length, the pygidial pleurae consist of ten pairs and for mature specimens which reach a length of two inches or a little more, eleven pairs is the normal number.

ENCRINURUS SILVERDALENSIS Etheridge and Mitchell. (Plate x., fig. 13.)

Encrinurus silverdalensis E. and M., Proc. Linn. Soc. N.S.W., xl., 1915, pp. 665-667; Pl. liv., fig. 11; Pl. lv., figs. 4, 9; Pl. lvi., fig. 4, 5, 6, 14; Pl. lvii., figs. 3, 10.

In the original description of this characteristic *Encrinurus* it was stated that the thorax and pygidium were finely granulated. Later evidence proves that these parts were coarsely tuberculate in a way which makes it easily distinguishable

tinuous; posteriorly the axis droops steeply and ends at the margin closely invested by the terminal pair of pleurae; axial grooves faint. Side lobes strongly inflated, fulera close to the axial grooves, from thence the lobes deflect almost vertically; each pair of pleurae from the second to the ninth pair posteriorly has a decided *f*-like shape; apparently there are twelve pairs of pleurae, certainly eleven, ending at the margin with a straight edge, and the whole pygidium has the form of an equilateral triangle. Dimensions: Length, 7; width, 8; height, 3; anterior spread of axis, 2.5 mm. A compressed specimen has length 7, width 5, spread of axis 2 mm.

That the pygidia formerly referred to (*loc. cit.*), and again described above, belong to *Encrinurus duntroonensis* seems a reasonable conclusion because they are the only pygidia found associated with the cephalon on which the species was established, and the glabella of the type cephalon is narrow, and consequently, the axis of its thorax and pygidium must also have been (unusually) narrow as is the case with the pygidia under notice; for these reasons I place them with that species without hesitation.

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A careful study of a large number of specimens of this species enables me to add an important point or two to former descriptions. In the original description by the late R. Etheridge, junior, and Mitchell the axis of the pygidium is said to terminate mucronately and to possess twenty-six rings; but instead of that some well preserved pygidia show that it ends in a fairly fine, rounded point in front of the submucronate terminal formed by the coalescence of the last pair of the pleurae; and that it bears thirty-two annulations, or more, in mature specimens, also, in the description referred to, doubt was expressed whether there were ten or eleven pairs of pygidial pleurae. It may now be stated definitely, that in all specimens of the species which do not exceed 1½ inches in length, the pygidial pleurae consist of ten pairs and for mature specimens which reach a length of two inches or a little more, eleven pairs is the normal number.

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In the original description of this characteristic *Encrinurus* it was stated that the thorax and pygidium were finely granulated. Later evidence proves that these parts were coarsely tuberculate in a way which makes it easily distinguishable

from all other Australian species of *Encrinurus*. Also (*loc. cit.*) it was stated that the axis of the pygidium is made up of thirty or more annulations; but a well preserved and approximately mature specimen of the species shows it to have only twenty-six rings and that the axis does not quite reach the posterior margin, and subtending its termination is a short convex piece between the posterior pair of pleurae. Another important feature about this species is, that the posterior pleurae of the pygidium are strongly folded under the margin. This feature does not occur in any other *Encrinurus* yet described from Australia.

An additional reference to CORDANIA GARDNERI Mitchell.

Since the publication of the paper in which this trilobite was described (Proc. Linn. Soc. N.S.W., xlvi., 1922, pp. 535-540, Pl. liv., figs. 1-7) Mr. T. H. Pincombe had the good fortune to find an almost perfect specimen of the species which he kindly passed on to me for study. This specimen (Plate x., fig. 15) permits the following modifications of the original description: The form of the eye is sublunate rather than reniform; the axis of the thorax is practically as wide as the combined width of the two side lobes; and the genal spines reach to the fifth thoracic segment.

Family BRONTEIDAE.

BRONTEUS (GOLDIUS) SINGULARIS, n.sp. (Plate x., fig. 8.)

In my collection there is a nearly complete thorax of a trilobite which I have placed in the genus *Bronteus*. Its description has been withheld for many years, hoping that some better specimens of it might be secured.

The specimen shows an almost complete axis and the two side lobes of a thorax, with, on one side, several appendages attached to the pleurae; these parts closely resemble *Bronteus*, but the thorax seems to have eleven rings, an unusual number for the genus. One of these rings may, however, be the neck-ring. There are three almost complete appendages of the pleurae on the left side, and three others of which proximal parts only remain. The side lobes and the mild convexity of the axis are characteristic of the *Bronteus* group. The axis and side lobes are approximately of equal width and some of the segments bear on their surface, striae such as are found only on *Bronteus*. The appendages of the pleurae are subsickle-shaped. Dimensions: Length of thorax, 20 mm.; width, 18; width of axis and of the side lobes, 6 mm.

The present determination of this fragment is only a tentative one and made largely for the purpose of drawing attention to it.

Loc. and horizon.—Lower Trilobite Beds of the Bowning Series, Minahan's selection, Bowning Creek.

BRONTEUS PLATYNOTUS, n.sp. (Plate x., fig. 9.)

The only specimen of the species known is a whole individual, but unfortunately the head is turned under the thorax, and most of it is hidden. From the portion of it exposed, the following particulars are noticeable: Battle-axe-shaped, very mildly convex, adorned anteriorly with concentric striae only visible under a lens, and laterally, at least, these are crossed by coarser anastomosing lines. Eyes reniform, large, faceted. Neck-furrow narrow; neck-ring stout. Thorax evidently consists of ten segments, which are transversely striated, mildly convex, oblong and twice as wide as long. Axis mildly convex, relatively wide, its spread being equal to the combined width of the side lobes; axial furrows faint. Pygidium large, oblong-semicircular, slightly convex, adorned with very fine

from all other Australian species of *Encrinurus*. Also (*loc. cit.*) it was stated that the axis of the pygidium is made up of thirty or more annulations; but a well preserved and approximately mature specimen of the species shows it to have only twenty-six rings and that the axis does not quite reach the posterior margin, and subtending its termination is a short convex piece between the posterior pair of pleurae. Another important feature about this species is, that the posterior pleurae of the pygidium are strongly folded under the margin. This feature does not occur in any other *Encrinurus* yet described from Australia.

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concentric striae; its axis is small, trilobed, smooth, shows no signs of segmentation, and is separated from the ribs by a shallow furrow. The ribs are fifteen in number, separated by shallow, but distinct furrows; at the margins they are all about of equal width and smooth but for the fine striae already referred to. Dimensions: Head, long 7, wide 14 mm. approx.; thorax, long 5.5, wide 11 mm.; tail, long 9, wide 11 mm.; spread of axis, 5.5 mm.

This *Bronteus* belongs to the group having the midrib of the tail entire. Its distinguishing features are: The great relative width of the thoracic axis, the relatively long, spined terminals of the thoracic segments, the shortness of the portions of these segments between the axial furrows and the fulera, and the very fine concentric striation and smoothness of the pygidium.

Loc. and horizon.—Minahan's selection, Bowning Creek, 1½ miles N.W. of Bowning township. Lower Trilobite beds of the Bounyongian beds.

EXPLANATION OF PLATE X.

Fig. 1.—*Cryptonymus platynotus* Mitchell. (x 1.7). Coll. Mitchell.

Fig. 2.—*Cryptonymus incertus* Mitchell. (x 1.7). The left side shows the pleural segments in their normal state. Coll. Mitchell.

Fig. 3.—*Cryptonymus robustus* Mitchell. (x 1.2). An almost complete specimen, slightly depressed, shows the varioloid markings and other features distinctly.

Fig. 4.—*Cryptonymus perannulatus* Mitchell. (x 4).

Figs. 5, 6.—*Cryptonymus angustus* Mitchell. (x 1.7). Owing to the poor-ness of the photo the features in fig. 6 have been lined in with ink.

Fig. 7.—*Encrinurus frontalis* Mitchell. (x 1.6).

Fig. 8.—*Bronteus (Goldius) singularis* Mitchell. (x 1.7). A photo of a mould or cover (intaglio).

Fig. 9.—*Bronteus (Goldius) platynotus* Mitchell. (x 1.7). Some of the features inked in.

Fig. 10.—*Cryptonymus (Encrinurus) duntroonensis* E. and M. (x .85). A pygidium showing distinctly the plough-share-like character of the pleurae.

Fig. 11.—Photo of the wide, and supposed normal form of tail of the above species.

Fig. 12.—*Encrinurus mitchelli* Foerste. A very well preserved specimen, complete but for the displacement of the free cheeks. The pygidium is perfect and shows all the normal features clearly. (x 1.7). The photo is from a squeeze from a mould.

Fig. 13.—*Encrinurus silverdalensis* E. and M. (x 1.7). Shows the characters of a nearly complete, testless tail of the species, and the punctuation of the thorax.

Fig. 14.—*Encrinurus mitchelli* Foerste. (x 1.7). A large tail which shows the axis with twenty-eight to thirty rings and pleural lobes with eleven pairs of segments; also, faintly, the granulation of the pleurae.

Fig. 15.—*Cordania gardneri* Mitchell. A complete testless specimen of the species which was not available when the species was described. (x 1.7).

All the specimens figured (except fig. 15) are in the writer's collection.

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